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Progress Report

Period of January 15, 1962 to February 15, 1962

Contract No. AF33(600)40280

Flight Test

General

Between January 15 and February 1, the aircraft was on modification status. Outstanding maintenance items were worked off during this period to prepare the aircraft for flight. Modification of the aircraft to the stage required for the first (pilot proficiency) flights was completed on February 1. Three flights were made on February 5 and 6 and the aircraft was returned to temporary modification status thereafter to complete the installation of the antenna pod and system components. The pod installation was completed on February 9 and the flight to check pod behavior in the air was made on February 13. At the present time, final system checkout on the ground is being accomplished while the next due hourly inspection is being made on the aircraft.

Installation and Checkout

During this reporting period, progress was made in the following areas:

1. Door equipment installation completed. Modifications are being made to provide additional cooling air to the KPA.
2. Nose equipment installation completed.
3. Cockpit equipment installation completed. Modifications for additional APQ-93 switches are completed.
4. Radomes - APQ-93 and APN-102 radomes received and installed.
5. Antenna Strut and Pod fabrication and installation completed with dummy antenna. APQ-93 antenna installation and alignment check are in progress.

6. APN-102 and ASN-25 equipment installation completed. Checkout performed with assistance from GPL representative. Modifications to APN-102 proved compatible with APQ-93 input requirements.
7. Pod Pitch Stabilization system installation completed. Ground check revealed some pitch oscillation induced by lateral displacement of the pod. During the pod flutter flight, the stabilization system performed satisfactorily. Results of this flight are discussed in the Data Analysis section of this report.
8. Over-all aircraft wiring completed.

APQ-93 System Tests

The APQ-93 system was operated both on the ground and during flight.

Modifications are being made to correct malfunctions in the following areas:

1. Receiver noise failure circuit.
2. CRT failure circuit.
3. KPA overheating (greater flow of cooling air).
4. Light leak in recorder.
5. Distortion of the Klystron magnetic field in the Modulator. (Part of the steel mounting plate is being cut away).

Data Analysis

One flight was made during the reporting period from which data was obtained. The purpose of this flight (S-3) was to determine the characteristics of the antenna pod in flight over the entire speed range.

The oscillograph recordings of lateral and normal accelerations of the pod were partially useless because the high frequencies encountered blurred the traces. Hence a high level of confidence should not be placed in the results regarding these accelerations. Lateral accelerations had amplitudes of about ± .1 G (± 3.22 ft/sec^2) and occurred at frequencies of about 120 and 15 cps. These characteristics seem constant for M.9 and M 1.5 speeds, and with the antenna stabilized or in its faired position. However, because the frequencies were higher than the galvonometer's response, the amplitude could be distorted. Normal accelerations recordings either fell on top of the lateral accelerometer recording or were not recorded at all. No information could be obtained from this signal.

The vibration transducer on the antenna pod showed a primary vibration at M.9 of about 95 cps with amplitudes of ± 1 G to ± .5 G. Integrating the vibration twice, it was seen that the antenna moved ± .0022" to ± .0011" at the point where the vibration transducer was located. As the speed increased to M 1.5, the vibrations decreased to about ± 0.6 G to ± 0.3 G and the frequency increased to about 140 cycles. The oscillograph recordings indicated no change in vibration when the pod was stabilized as compared to when it was faired except for a short period of about 2 seconds immediately after change of pod position from "full bottom" to a stabilized point or vice versa. When the pod was stabilized, the instrumentation indicated a .08° nose up attitude. Also in this mode a ripple of about .1° peak to peak and 8 to 9 cps occurred at rather even intervals of about 1.7 seconds. Correlation of this ripple to other parameters measured has yet to be found. Since the pod has a 4 cycle

response, (the E_{out}/E_{in} characteristic has a 90° phase shift at about 4 cycles) it will not follow this high frequency error signal. The origin of this ripple is being investigated.

Recordings of pitch and roll were normal except that oscillations of about ± .2+ and ± 1° respectively were noticed. Those occurred only in an "altitude hold" mode of auto-pilot operation. The pitch oscillation had a frequency of about .55 cps while the roll had a .5 to .7 cps oscillation. There is some correlation between roll and "heading error". The heading error had .6° peak to peak oscillations about 0° of the same frequency and occurred at about the same time as the roll oscillations.

Signals associated with the APN-102 doppler navigator, (ground speed, drift angle, distance off track, and track error) were not analyzed because the doppler navigator was not "locked on" during the flight and therefore all the above were primarily random signals.

The antenna accelerometer recording indicated a +.6 G output that was primarily constant throughout the flight. However the point instrumented in the accelerometer circuit supposedly had 15 VDC on it. This theoretically should have driven the galvonometer off the recording paper. Another oddity is the usual constant output while the pod is cycled. Only a few times did the antenna acceleration change while the pod moved.

The thermistor connected for the flight indicated a constant 60°F for the Duplexer Driver Surface temperature.

The recording of the power supplies was of no use due to the failure of a "ledex" switch. Also the data correlation pulses were missing. Both of these faults are being repaired.

A strange ripple of about 15 cps occurred on several channels even during the calibration periods. Since the largest ripples occur on channels that have a type #325 galvo, the probable cause of the oscillation is vibration of the recorder, since the natural frequency of the #325 galvo is about 15 - 19 cps.

Plans for future flights include summing the lateral and normal accelerometers in a manner so that the output can be compared with the antenna accelerometer. Also adjustment of the ground speed recording will be made to increase the sensitivity around 530 and 830 knots. The discrepancies listed throughout the proceeding discussion will of course be investigated.

Instrumentation

During this reporting period, the instrumentation configuration in the F-101B was completed. Units and wiring were installed and checked out.

Analysis of the oscillograph recording made during the pod checkout flight (February 13) brought to light several discrepancies with the present configuration.

At present, work is being done to correct these discrepancies and ready instrumentation for the first data flight.

Planning

Work on the system and on instrumentation is being continued in an effort to eliminate problem areas so that the first data flight will be successful. During this flight attempts will be made to determine gain settings which will optimize system performance in the flight environment.

During the next reporting period efforts will be directed toward maintaining the APQ-93 and auxiliary equipment in operative condition and obtaining valid data during the system flights made.

Antenna

Flight Test Antenna

Electrical and mechanical tests of the Flight Test Antenna were completed and the antenna was delivered to the project group on 22 January 1962 for further evaluation and aircraft installation.

Fabrication (Antennas #2 and #3)

Manifolds: A total of seven manifolds of the eight required for antenna #2 has been received and accepted to date. An eighth manifold was received but was rejected after electrical test and returned for rework. During rework, this manifold was broken; a new manifold to replace it is being made and has been promised 21 February.

Array Sticks: A total of 149 sticks (including a full set of 128 for the #2 antenna) has been received. 133 of these (127 for the #2 antenna) have been sealed and are ready for assembly or are already assembled into modules.

Modules: Two of the eight modules required for antenna #2 have been "grown together" and are currently being tested prior to assembly to the antenna support beam. An additional three modules are presently at Gar being "grown together". The remaining three modules for antenna #2 will be assembled and sent to Gar by 23 February.

Power Dividers: Phase measurements made on the complete power divider matrix for the flight test antenna revealed two problem areas. First, three of the power dividers required a counterclockwise twist rather than

a clockwise twist to give the proper phase distribution. Second, phase shift "trimmers" are required to insure the necessary phase coincidence at the power divider output terminals. These "trimmers" are being incorporated in the design of the power divider matrix for antennas #2 and #3. The incorporation of these phase shifters has resulted in approximately a two week delay in delivery of the power dividers.

Duplexer

All three duplexers have been assembled, inspected and installed in the following systems:

Flight Test System, Duplexer #1

Design Evaluation System, Duplexer #2

System #3, Duplexer #3

Because of leakage to the receiver during the resonant ring charge time, it has been found necessary to install an isolator and TR tube between the duplexer and TWT. Average power leakage in the order of 3 watts is decreased by this combination of isolator and TR to less than 1 mw, while insertion loss is less than 0.7 db. To date, it has not been found necessary to use a keep-alive for the TR due to the relatively slow rise time of the leakage pulse.

Switches

The EGG switch, with sweeping electrodes, appears to provide satisfactory operation up to power levels of 500 kw peak in the ring. However, it has been found necessary to use air, rather than nitrogen, in the switches, and to have an air flow (slow leak) through the switches

to prevent O2 clean-up and O zone formation. Back-wall spacing appears to be most favorable at .920", dome to back-wall spacing in the EOG configuration.

Duplexer Driver

All three units have been assembled and inspected. Difficulties, with the charging choke and thyratrons in this unit have required investigation. To date, it appears to be manufacturing problems i.e., lack of impregnation of insulation on chokes, and cathode contamination on thyratrons; rather than operating levels, that have caused difficulties.

Power Monitor

All three units have been assembled and inspected.

Switch Tubes

A WX-4641 tube was constructed this month which produced the required isolation under high power operating conditions. At 60 kw of incident power, an isolation of 15 db was obtained. The modulator was run at a PRF of 3600 cps in order to duplicate system conditions as closely as possible.

Rise time was not accurately determined because of the lack of a sampling scope. Recently, a HP188B sampling scope was obtained and it will be possible to measure the rise time. However, first the source of a 400 mc ripple appearing on the sweep must be located and eliminated. This ripple at present is resulting in an inability to read nanosecond breakdown times.

Three models of the WX-4641 were constructed. As yet, none has been tested in the actual system. In the meantime, further development work is being done to simplify and improve the tube.

A WX-4554 was also constructed and tested this month. This tube has been tested at 110 kw per window at a PRF of 3600 cps. Full power cannot be obtained with the present modulator and for such testing it will be necessary to rebuild the ring circuit. Reconstruction of the ring circuit will not be started at this time, however. At present, effort is being spent in more precisely locating the plane of the short in order to improve rise time and phase shift parameters. Another objective of this effort is to reduce tube insertion loss.

Modulator

Three pulse packages failed during the month due to defective capacitors in the PFN. The manufacturer has procured new capacitors which should eliminate this problem.

It has been found that the pulse package overheats after one hour of continuous operation at full high voltage. In order to improve cooling this unit has been separated into two units, the pulse transformer and the PFN, with improved mounting for both. Shipment of the first set of these components has been scheduled for 16 February 1962.

Except for the above, all assembly work and testing of three modulators has been completed.

Receiver

TWT

The third TWT assembly has been completed. All capacitors have been received for the power lead filter boxes. Modification filters #1 and #2 are not yet completed.

I.F. and Video Amplifiers

As previously reported, all three of these units are complete and have been tested.

Synchronizer

The sync. generators and synchronizer units have all been functioning properly. Some of these units have logged over 200 hours without failure.

Some rework is anticipated on the synchronizers to incorporate a 13 mc output for use with the ground test equipment. This will be incorporated when the necessary components are received. Present delivery schedule is approximately 9 March 1962.

Stalo and Receiver

Installation of the new cross guide coupler with test arms is nearing completion in Receiver #1. The stability and power output of the stalo portion of this unit has been rechecked with the new laboratory stability tester, LFE 5004, and was found to be satisfactory.

Receivers #2 and #3 are in systems #1 and #2 respectively. The new cross guide couplers have not as yet been installed in these units.

Recorder

General

The acceptance test for Recorder #2 was held on 17 January 1962.

This test was held using an American Cystoscope fiber optic unfolding array.

The test was completed and the recorder accepted based on the condition that an acceptable power supply and fiber optic array be installed when available.

Assembly of Recorder #3 has been started.

Design of the Conventional Optics Recorder #4 has progressed according to schedule such that the design of the majority of the components have been completed and the detailing phase started.

Releases were made for the fabrication of the following:

1. Prism assembly.
2. Structural parts (side plates and the rods).
3. CRT assembly. Only peculiar parts not common to the fiber optics recorder.
4. Data projector assembly.
5. Mirror assemblies.

Design of the outer skin was completed and is being detailed.

The invar material which was ordered in advance has been received.

Electrical

The location of the four miniature data lamps has been changed from within the data block assembly to a position on the opposite side of the film. The lights are mounted so as to expose the film directly. The

previous location within the data block did not permit enough light to reach the film to expose it properly. A technical note on the driver circuit for the miniature data lamps is included with this report on page 13 (Figure 1).

The 4 kc blanking flip-flop and amplifier circuit has been modified by the inclusion of an emitted follower as a buffer stage between the two circuits. This change increases the stability of the circuit. All changes are being incorporated on the schematic and assembly drawings.

Fiber Optics

Mosaic fabrications are working with rectangular fiber bundles and report that this type of fiber is difficult to fuse because of breakage during the annealing process. A second array of 10 micron fibers was received from American Cystoscope during the report period. These fibers have replaced the Mosaic fabrications array in Recorder #1. Tests on these fibers will be conducted during the next reporting period.

The breadboard high voltage power supply was replaced with an approved power supply.

Collection of data on film emulsions for the lens recorder is continuing. A test report on sensitometric evaluation of a series of blue-sensitive spectographic films is appended.

Miniature Lamp Driver Circuit

A circuit was devised to properly illuminate each of four Sylvania ML-202A miniature lamps by placing each lamp in the collector circuit of an NPN silicon transistor, SYL-2860, and driving each base, through a 2.7 K resistor, with the 8 to 12 volt input pulse. Since only one lamp is driven

FIGURE 1

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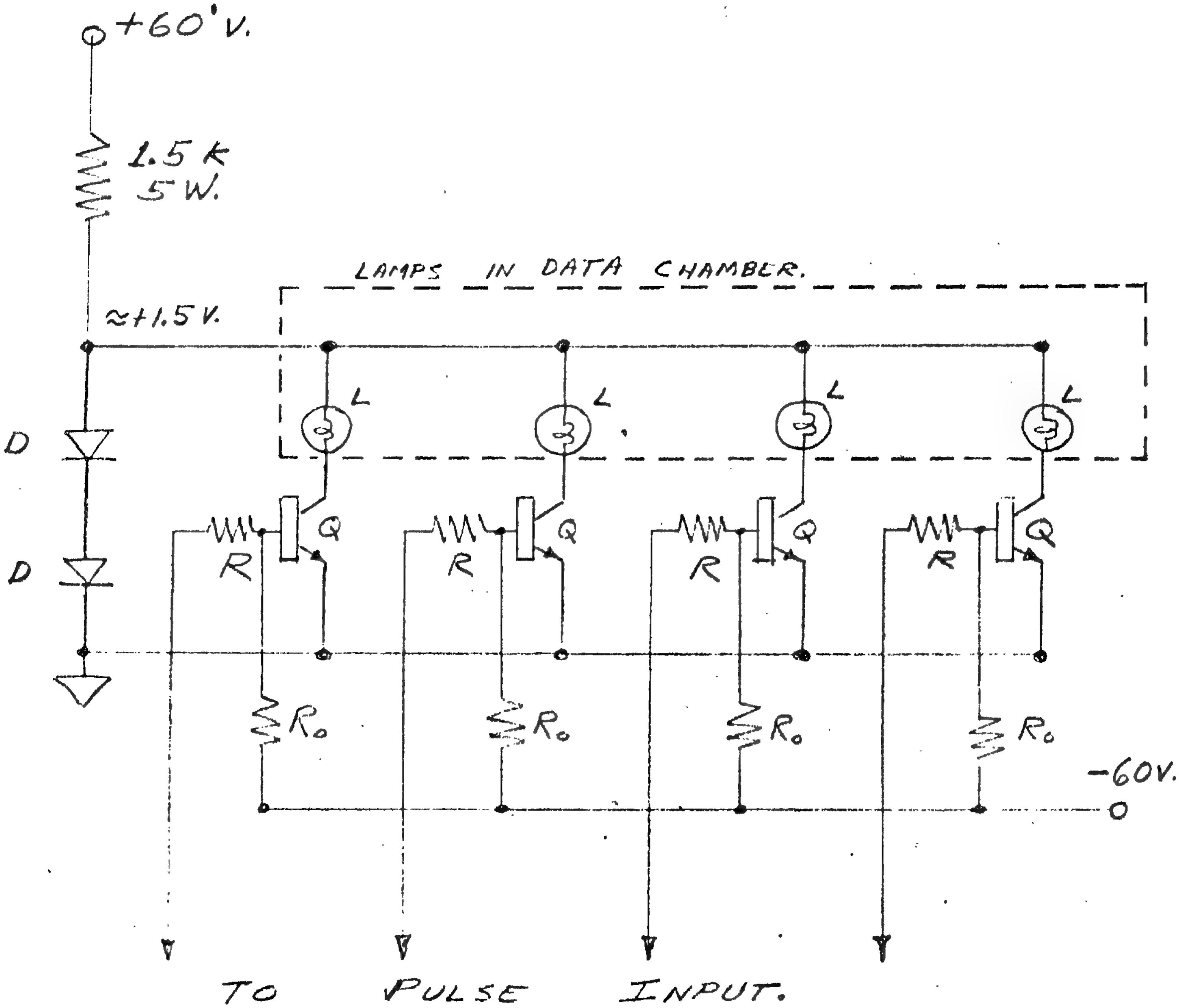
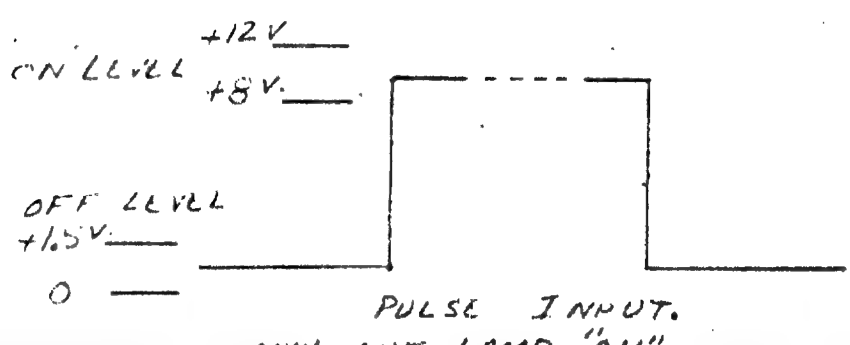
DATA LAMP DRIVER CIRCUIT.





D G129 (T.I.)
Q SYL 2860
L ML-202A (SY
15-30 ma.
R 2.4K ½ W.
R_o 100 K ½ W.

9134: 17 NOV. 61 NPG

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at any one time, and a lamp draws from 20 to 30 ma. The 1.5 volt regulator need only supply this amount of current.

Figure 1 on page 13 shows how this +1.5 volt nominal supply voltage is derived from the +60 volt DC supply bus. Two forward biased small glass silicon diodes in a series connection establish the collector supply for the lamp loads. With no lamps "ON" the diodes pass about 35 ma which is well within their 250 ma maximum rating. The entire unit, except lamps, is packaged on a single terminal board 2 by 3 inches in size mounted on the recorder frame. This circuit thus efficiently performs the function of illuminating each of the four lamps when a signal appears at the base resistor of the appropriate transistor.

Navigation Tie-In

A bias supply for the control rectifiers which drive the ground speed step-motor has been installed so that the ground speed can be slewed when the remainder of the system is off.

Further test points have been added so that all units will be the same as the one in the flight test system.

Unit #3 test is approximately 80% complete.

Alignment and linearity tests have been run with Unit #1 which is in the flight test system coupled to the AN/APN-102 navigation system.

Power Supply and Control

All power supplies and control panels have been completed.

Frame (Electrical)

The wiring of frame #3 has been completed. Wiring of all three frames is now complete.

Frame (Mechanical)

With the completion of frame #3, as reported in the previous period, all three frames are complete.

Truss

Layouts have begun in drafting and the truss stress analysis is approximately 30% complete.

System Stress Analysis

Installation loads have been determined and a report will be available during the next reporting period.

The frame analysis is being brought up to date to reflect the latest major assembly weights and C.G. location.

System Interconnections

Cables for systems #2 and #3 have been completed and installed.

The status of system #1 cable is the same as reported in the previous period.

System Handling Equipment

With the completion of the third system test cart, as reported in the previous period, all three test carts are complete.

Composite Tests

System #2 was delivered (with minor exceptions) on 31 January 1962.

The following units of system #3 have been installed on the frame and power distribution was checked out on all unit connectors:

Power Supply

Control Panel

Accelerometer

Synchronizer

Power Monitor

Nav Tie-In

Pressure System

Duplexer

Video Amplifier

Aux. Recorder

The remaining units are being completed and inspected.

Pulses from the sync-generator were checked and found to be satisfactory.

Test Equipment

Composite Test Equipment

There has been no work performed on this aspect of the job during this period.

Design Evaluation Equipment

The design, breadboarding, test and fabrication of all the test equipment, with the exception of the Azimuth Test Pattern Generator and the Azimuth Resolution Optics Assembly is progressing within the predicted schedule. As in the past, the major bottleneck to meeting the schedule is the delivery of purchased parts.

The problems and areas of progress will be detailed in the following paragraphs.

Transponder

The Transponder is ready for use except for the silk screening of nomenclatures on the front panel.

Clutter Generator

This unit is finished with the following exceptions:

An amplifier and mixer must be built, however, this is a carbon copy of stages designed, built and tested for the Azimuth Resolution Test Pattern Generator. The nomenclatures must be silk screened on the front panel.

The item which will cause this unit to be unavailable by 1 March is the antenna pattern filter. This filter is being designed and built by an outside source. The promised shipping date is 9 March. As an interim fix we will design and install a simple bandpass filter. This will not duplicate the system exactly but it will make the clutter generator usable until the desired filter is obtained and installed.

Range Resolution Test Pattern Generator

The 10 nanosecond pulse generator for use during the Range Resolution Test and the Dynamic Range Test has to be "cleaned up" and installed in the chassis. When this is accomplished along with the silk screening of nomenclatures on the front panel this chassis will be ready for installation in the test equipment rack.

Azimuth Resolution Test Pattern Generator

Fabrication of the goniometer drive was completed and the servo loop was closed. Due to the technique used to apply the motor drive voltage (clamped to a back bias) the motor overheated. The least drastic change to overcome this condition was elimination of the back bias and the redesign of the gear train. The redesigned gear train will be assembled in the Model Shop. The piece parts for this assembly are promised from the Model Shop by Tuesday, 20 February and the assembled gear train is promised by Friday, 23 February.

All of the electronics for this unit, which includes the servo electronics as well as the dividers multipliers etc., which handle the signal, have been completed with the exception of an amplifier to isolate the bandpass filter output. Also, a light source and photo diode for the goniometer speed control circuit must be installed in the gear train when it is received from the Model Shop.

Design and fabrication of the jitter free delay circuit is progressing. The unit consists of fifty plug-in boards of which eleven are complete. The rest are "hung up" for lack of purchased parts,

specifically 2N744 transistors and FD824 diodes. Delivery of these has been promised by next week. The boards should be fabricated by the end of next week. Fabrication of the chassis which will hold the boards should be completed by the end of next week. Testing of the assembled chassis should be completed in a week or less. Therefore, the unit complete and tested should be ready to install in the test equipment rack no later than 2 March.

Although it appears that the work to be completed can be accomplished by the first week in March, the test equipment cannot be delivered by that time. As mentioned above, the filter from an outside supplier, will be shipped 9 March and must be installed in the Azimuth Resolution Generator.

A backup method of obtaining a rectangular main lobe along with rectangular side lobes is being designed and breadboarded. This method will not produce as true a simulation of a target as can be had with the desired filter. If necessary, this technique could be used as an interim fix until the antenna pattern filter is delivered. This will, however, require a modification to other parts of the system when the interim fix is installed and remodification of these parts when the fix is removed and the antenna pattern filter is installed.

Design and fabrication of the test equipment to perform the Pulsed R.F. Stability Test has begun. This unit will operate independent of the rest of the test equipment except that it will make use of the power supplies. Therefore it will not effect delivery of the remainder of the test equipment.

Azimuth Resolution Optics Assembly

All piece part drawings have been released to the Model Shop. The assembly drawing will be completed next week. All piece parts and subassemblies have been promised the early part of the week of 26 February by the Model Shop.

Assuming that the Model Shop will hold to or better this schedule the unit should be assembled and operating in the week ending 3/11/62.

Operation of the breadboarded portions of this unit indicate that some difficulty may be encountered due to insufficient light intensity.

Some modification to the condensing lens system as well as replacement of the light source may be necessary to overcome this difficulty.

Range Resolution and Dynamic Range Optics

All piece parts have been received from the Model Shop. Assembly work on the unit is being done in the Engineering Lab. The assembled unit should be ready for its final checkout early in the week of 4 March.

Film Evaluator Electronic Circuitry

The counter circuitry has been designed, fabricated and tested in its final package.

The photodiode reset circuitry has been installed in the optics assembly.

All of the film evaluator electronics will be available by the week ending 3/4/62.

Mechanical Design and Packaging

The cabinets have been received and the blowers and wiring harness are being installed.

Doppler Frequency Tracker

The booster amplifier was breadboarded and tested. Its design, after some refinements, is reasonably settled.

The range gate generator was designed and breadboarded. Initial tests were favorable, but considerable debugging will be required.

The signal-presence amplifier was designed. It is being breadboarded.

The toroid coils and component ovens for the spectral line filter and discriminator filters were selected and ordered. A graphical analysis of 2-pole filter outputs with a simulated clutter spectrum input helped to predict performance of the above filters. Both Butterworth sections and standard tuned circuits were used. The results will be useful in deciding on bandwidths and resonant frequencies.

The DFT will not physically replace the Navigation Tie-In unit in the flight-tested radar. Rather, it will occupy a space on the door near the receiver and recorder. The allotted volume is approximately a cube, 10 inches on a side. DFT packaging concepts will be investigated on this basis.

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APPENDIX

PHOTOGRAPHY DEPARTMENT

Test Report

Project 9134 01EL

Sensitometric Data for Several Films when Exposed
to Simulated P-11 Phosphor Illumination
Part II

by

25X1

[redacted]

29 January 1962

25X1

Approved [redacted]

Approved

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Itek

Photography Department

Research and Professional Division

Sub-Project No. 9134.01E1
Sub-Project Title Film Evaluation
Date 29, January 1962
Prepared B [redacted]

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TEST REPORT

PERSONNEL [redacted]

TEST DATE Jan. 19 - 23, 1962

DESCRIPTION OF TEST Comparison of Several Films when Exposed to Simulated P-11 Phosphor Illumination - Part II*

MATERIAL/APPARATUS UNDER TEST E.K. Spectroscopic Films: 2-o, 3-o, and 4-o

TEST EQUIPMENT EG&G Mark VI sensitometer, thermos agitator, Ansco-MacBeth model 12A densitometer, Itek Resolving Power Test Camera: model II, B & L binocular microscope with substage condenser

PROCEDURE

1. Three strips of each film type were exposed on the sensitometer for 0.001 sec. through a Wratten #48 filter. This exposure simulates the illumination from a CRT with P-11 phosphor.
2. The strips were processed in D-19 for 6 min. at 68°F using the thermos agitator.
3. The strips were read on the densitometer, averaged, and used to plot D log E curves.
4. The speeds of the three films relative to E.K. 5427 were determined at a density of 0.60. The D log E curve for 5427 was determined in Part I of this report.
5. Two strips of each film type were exposed in the resolving power camera - one to a high contrast (1000:1) and one to a low contrast (2:1) target using simulated P-11 phosphor illumination. The exposure times were 0.125 sec. for the 2-o material, 0.5 sec. for the 3-o, and 1.0 sec. for the 4-o. Five exposures each were made at nominal 0.2 log E increments through a 1.4 log E range for both target contrasts.
6. The resolving power strips were processed in D-19 for 6 min at 68°F using the thermos agitator.
7. The resolution readings were made on a B & L microscope with substage condenser using simulated daylight illumination. The magnifications used were: 16.5X and 50X. The readings were averaged and the highest average values are reported.

* Part I of this report (Photography Department Report 316) was issued December 15, 1961.

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RESULTS:

E.K. Spectroscopic type 2-o film was by far the fastest of the three films tested. It is 16 times (4 f-stops) faster than E.K. 5427, Aerographic Duplicating film, to simulated P-11 illumination. It is approximately one f-stop slower than E.K. Tri-X Pan and one f-stop faster than SO-102, a Plus-X type aerial film. Its maximum high and low contrast resolving power values, 95 and 45 lines/mm are 6 lines/mm higher than those attained with the Tri-X Pan.

The type 3-o film was only 3.3 (1-1/2 f-stops) faster than 5427. Its high contrast resolving power (80 lines/mm) was even lower than that achieved with Tri-X Pan. It had the lowest gamma of the three films tested, 2.20.

The type 4-o film was the slowest of the three films. It is only 1.7 times (slightly more than 1/2 f-stop) faster than 5427. It produced the highest gamma, 4.2, and the highest resolving power values of the three spectroscopic emulsions. A high contrast resolving power of 106 lines/mm and a low contrast resolving power of 56 lines/mm were recorded on this film. Comparing these values with the type 2-o film, a sacrifice of better than 3 f-stops must be made to gain an extra 11 lines/mm.

The results of these tests are tabulated in Table I.

TABLE I

Film	Speed Relative to E.K. 5427 at Density - 0.6	Gamma	Fog Level	Resolving Power in Lines/mm	
				High Contrast (1000:1)	Low Contrast (2:1)
E.K. specroscopic Type 2-o	16.2	2.78	.05	95	45
E.K. Spectroscopic Type 3-o	3.3	2.20	.06	80	42
E.K. Spectroscopic Type 4-o	1.7	4.20	.05	106	56
E.K. 5427	1.0	3.30	.04	---	--

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SENSITOMETRIC DATA SHEET

Itek Corporation

DATE 1/22/62

PROJECT 9134.01E1

PREPARED

FILM (TYPE) E.K. SPECTROSCOPIC TYPE 2-0

EMUL. NO. FW 6596-1

EXPIR. DATE

EXPOS. TIME 0.001 SEC

FILTER ATTEN. + W#48

LAMP NO. FT #218

DEV.	TIME	TEMP.	AGIT.
D-19	6'	68°F	T-A

FILM (TYPE) E.K. SPECTROSCOPIC TYPE 3-0

EMUL. NO. FW 6726-1

EXPIR. DATE

EXPOS. TIME

FILTER

LAMP NO.

DEV.	TIME	TEMP.	AGIT.

FILM (TYPE) E.K. SPECTROSCOPIC TYPE 4-0

EMUL. NO. FW 6725-1

EXPIR. DATE

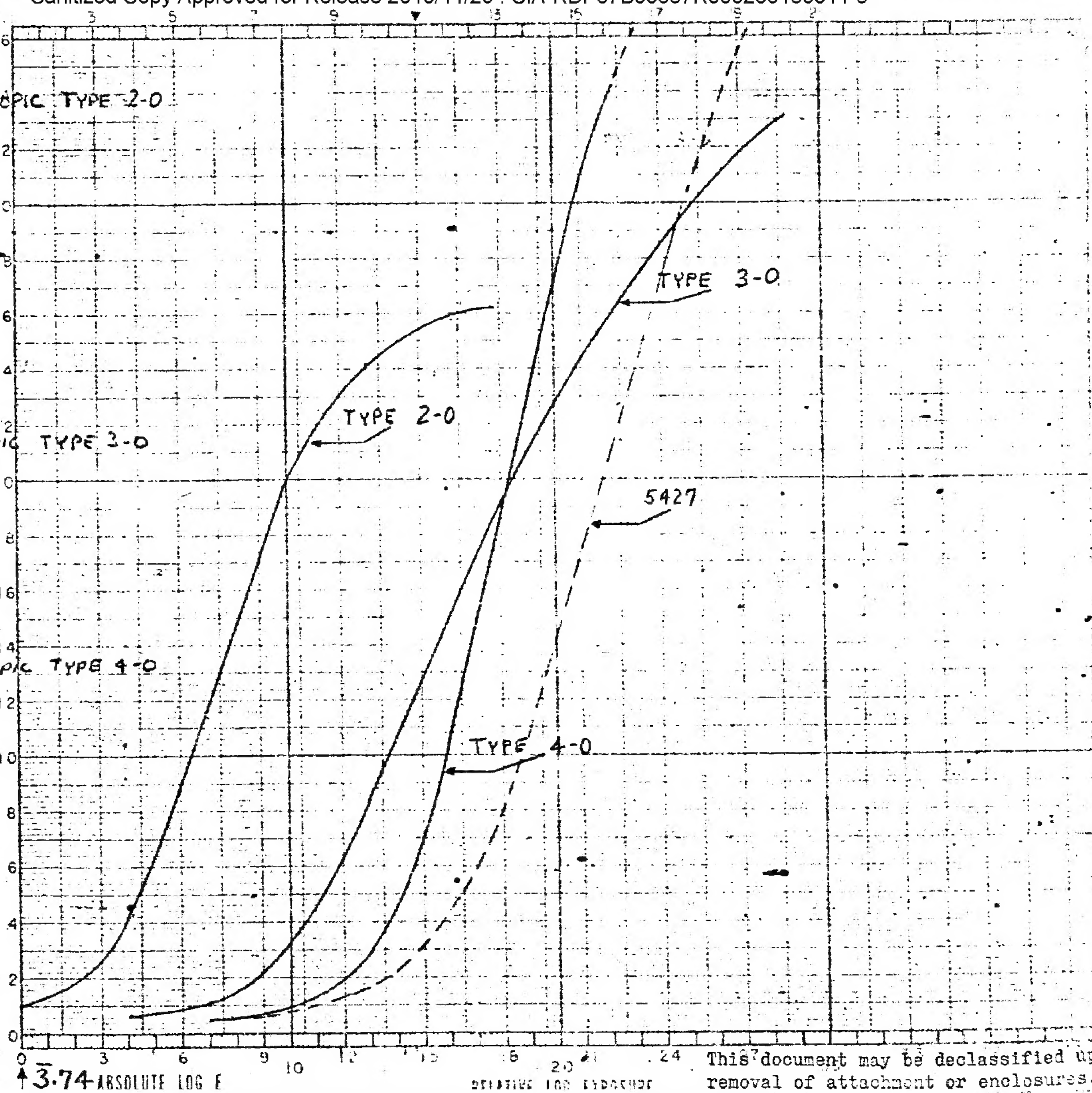
EXPOS. TIME

FILTER

LAMP NO.

DEV.	TIME	TEMP.	AGIT.

VAR	Y/2 SPEED	FOG	GAMMA
2-0		.05	2.78
3-0		.06	2.20
4-0		.05	4.20



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